Do ‘Protected Geographical Indications’ (PGI)-certified farms perform better?

The case of beef farms in Spain

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Abstract: *European rural development policy is gaining in importance through one of its key instruments, the Protected Geographical Indications (PGI) system, which is designed to improve quality standards. Previous research has shown that PGI-certified beef farms tend to be more extensively managed operations that are better adapted to mountainous areas. This paper describes a comparative study of two production systems, one with PGI certification and one without, focusing on a number of economic variables. The results show a positive association between PGI production and profitability. In efficiency terms, non-certified farms show better pure technical efficiency scores, while PGI-certified holdings score higher on scale efficiency.*

Keywords: *farm efficiency; farm profitability; beef farms; Protected Geographical Indications; Spain*

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In recent years, Common Agricultural Policy trends have led to liberalization processes that have forced more vulnerable farmers with less capacity to compete in market conditions – often due to their location in less favoured areas – to abandon farming activity.

These circumstances have mainly affected livestock specialists. In Spain, the livestock production systems under the most serious threat are precisely the two that contribute towards nature conservation (Behan *et al*, 2003). Both are extensive production systems, one located in a highland area, the other in a grassland area. In both cases, the animals are allowed to graze natural pasture, thus preserving the natural habitat (Evans *et al*, 2003).

Recent developments in the agro-food system are proving a challenge to producers in the less favoured regions of the European Union. The growing concentration of large-scale distribution centres has flooded the market with large and easy-to-handle quantities of homogeneous products. At the same time, consumer demand for differentiated products and willingness to pay a quality premium are heightening the role of geographical indications, which, in addition to offering a guarantee of better quality, also appeal to certain social values.

Meanwhile, international trade negotiations have put pressure on developed countries to remove or reduce any instruments in their agricultural policies that might distort international trade. European agricultural policy is turning increasingly away from price and market support and towards a rural development policy, which includes support for Protected Geographical Indication (PGI) labels, as a means to promote the products of less favoured regions.

One of the findings of previous analyses on the suitability of this instrument for promoting rural development in mountainous areas (Gómez *et al*, 2006) concerned the effectiveness of PGI in providing extensive farms with the means to promote their products and ensure their survival. Our overall aim is to compare some of the economic issues found to be involved in PGI and non-PGI production, and to contribute, if possible, to the design of sustainable development policies in the less favoured areas in which these production systems are present.

Recently, in view of the scarcity of existing studies on this subject (Bosmans *et al*, 2005; Anders *et al*, 2009) the OECD (2006) drew attention to the need for research to analyse livestock farm performance variation related to the adoption of different marketing strategies. The second objective of the study reported here, therefore, was to compare the performance of PGI-certified and non-certified farms. If the profitability of farms producing PGI beef is found to be higher, it will be possible to deduce that the quality policy makes a positive contribution to the survival of this type of farm.

A review of the literature reveals many contributions on the effects of farm management and production practices on farm technical efficiency (Galanopoulos *et al*, 2006; Hadley, 2006; Van Passel *et al*, 2006; Hansson and Öhlmér, 2008; Kamruzzaman and Manos, 2009). One of the main concerns of the study reported in this paper was to test whether participation in a quality scheme induced farms to make better use of the factors of production. There has been some research on differences between organic and conventional farms (Oude Lansink *et al*, 2002; Arandia and Aldanondo, 2007) and between transgenic and conventional production (Wossink and Denaux, 2006), but little relating participation in a quality scheme to farm technical efficiency (Dimara *et al*, 2005; Bosmans *et al*, 2005; Bouamra-Mechemache and Chaaban, 2010).

The focus of this analysis is on the PGI label *Ternera de Navarra* [Beef from Navarra], which is produced by approximately 700 livestock farms in the north of Spain. PGI requirements concern the breed of cattle, feeding regime and production system, which means that only certain types of farms (breeding-only farms) are eligible (Atance *et al*, 2004). In recent years, beef cattle production in this region has come to represent around 15% of total animal production, and the share of certified meat currently accounts for over 30% of the region's total beef production. *Ternera de Navarra* is among the top certified fresh meats in Spain (10% of total domestic PGI-labelled production).

The following sections of the paper deal with the data sources used in the study, the research methodology, the results and, finally, the main conclusions and potential economic policy implications.

Data

Profitability and efficiency are assessed for 2004 data obtained from the database of the Farm Accountancy Data Network (FADN) in Navarra, supplied by the Government of Navarra's Department of Agriculture. Since the FADN database does not indicate farms' PGI status, this information was obtained through consultation with agency managers.

Thus, out of a total sample of 42 farms, 28 are PGI-certified: that is, roughly 66% of the total. All of them are located in areas eligible for structural fund grants, and the majority (95%) are in less favoured mountainous areas. Family farms predominate (91% of the total).

With respect to structural characteristics, the main differences between the two groups are that PGI adopters are on average five years younger than the non-adopters, and their holdings are much larger (size measured in livestock units).

Methodological approach

Profitability analysis

Using data obtained by the Accountancy Network method, the issue to be investigated is whether the farms obtain sufficient output to compensate fully for the factors of production. This requires the estimation of some indicators relating to cost and output, which can be used as a measure of farm profitability, viability or competitiveness.

Output quantity was considered both with and without the current net subsidies received by livestock farmers. It also includes two separate cost estimates: the first based on the actual amounts paid by the farmers; the second approach including family labour and farmers' own capital cost. The cost of family labour is calculated according to the recommendation of the European Commission (2009) – that is, the cost of hired labour in the same sector. A similar criterion is adopted for land costs.

The available data enable the construction of Indicator 1 as paid costs/(output + current net subsidies), Indicator 2 as paid costs/output, Indicator 3 as estimated costs/(output + current net subsidies) and Indicator 4 as estimated costs/output.

Efficiency

The technical efficiency of a production unit can be defined as the minimum input required to obtain a given level of output. The measurement of technical efficiency is derived from the estimation of frontier production functions. The literature has developed two main methods of production frontier estimation, one parametric, the other non-parametric. This study uses the non-parametric model, which is estimated by means of Data Envelopment Analysis[1] (DEA). The global technical efficiency index (GTE) obtained is a scalar that represents the minimum to which the use of inputs can be reduced without altering the output level. A value lower than one is indicative of technical inefficiency.

This efficiency measure may be the result of comparing large-scale units with hypothetical small-scale units, or vice versa, which may prove impractical. To overcome this problem, it is possible to allow variable returns to scale (Banker *et al*, 1984). In this case, the model measures pure technical efficiency (PTE), regardless of scale issues.

Having obtained GTE and PTE estimates, the relationship between the two gives scale efficiency ($SE_i = GTE_i/PTE_i$), which can be interpreted as the

Table 1. Farm performance measures.

Item	PGI No	PGI Yes	Total	F (2)
Total output (1)	36,527	64,780	55,362	2.99**
Total output + net current subsidies (1)	47,098	101,326	83,251	5.25**
Total costs (1)	28,185	56,690	47,188	5.08**
Total costs/livestock unit (1)	676	685	682	0.03
Indicator 1	0.680	0.597	0.625	1.98
Indicator 2	0.957	0.974	0.968	0.03
Indicator 3	1.231	0.885	1.001	10.53***
Indicator 4	1.751	1.442	1.545	2.80**

(1) Figures in euros. (2) ** and *** denote statistical significance at the 10% and 1% levels respectively.

Table 2. Technical efficiency estimates.

Indicator	PGI No	PGI Yes	Total	F (1)
Global technical efficiency (GTE)	0.732	0.693	0.706	0.41
Pure technical efficiency (PTE)	0.945	0.832	0.870	6.3**
Scale efficiency (SE)	0.773	0.836	0.815	1.4

** denotes statistical significance at the 10% level.

additional input reduction that would be obtained if technology had constant returns to scale.

The model estimation uses data for the 42 livestock farms in the sample. The output quantity estimates are calculated exclusive of subsidies. The factors of production include area of utilized agricultural land, farm labour, number of livestock units, depreciation value, cattle feed costs and other intermediate inputs.

To identify the potential drivers of farm efficiency, the study proceeds to a second stage in which a function is defined to explain technical efficiency. The endogenous variable is censored between 0 and 1, and therefore requires the use of one of the statistical techniques developed to handle constrained variables, such as the Tobit model[2] (see Greene, 2003).

In terms of the variables that can be used as potential technical efficiency-determining factors, the available data only permit the inclusion of the following: age of farmer (AGE), farm size in economic terms (SIZE), current net subsidies (NETSUB), intensification level (LIVDENS), livestock specialization level (LIVSPEC) and two dummy variables to capture farm location (DLOCAT) and PGI registration (DPGI).

Results

Economic performance and profitability

The farm performance figures obtained are shown in Table 1. A comparison of agricultural output alone reveals major differences between the two farm types, with PGI farms earning an average of €64,780, *versus* €36,527 for the non-PGI farms, the differences being statistically significant.

In terms of output per livestock unit, although PGI-protected farms perform better, the differences between the two farm types prove significant only when subsidies are taken into consideration. This finding may be explained by the high subsidies paid to PGI-certified producers. In terms of the total amount of current farm subsidies received, non-certified producers receive an average of €10,572, *versus* €36,546 for certified farms. This shows a heavier reliance on subsidies among PGI producers, who receive amounts of up to 36.9% of their output value, as against the 27.2% received by non-certified farms.[3]

Total average farm costs amount to €47,188, with a quite considerable and statistically significant difference between the two farm types. No significant differences emerge when they are compared in terms of average annual cost per livestock unit, however.

Turning to the profitability indicators, the values that include paid costs (Indicators 1 and 2) do not differ significantly between farm types. Nevertheless, when costs are imputed to family labour and farmers'own land, as in Indicators 3 and 4, significant differences do emerge, and PGI-certified farms are observed to obtain higher profits, irrespective of the output estimate considered.

Technical efficiency

The average technical efficiency estimates (shown in Table 2) reveal a certain level of inefficiency in the observed farm sample. Global technical efficiency is actually lower among the PGI-certified farms than among the rest, although the differences are not significant.

Higher inefficiency scores are due more to the scale of production than to pure technical efficiency. Nevertheless, variation in performance is observed between the two types of farms, in the sense that, on average, non-certified farms show higher pure technical efficiency. Furthermore, the analysis of variance shows that the differences between PGI-certified and non-certified farms are statistically significant. A possible explanation for this variation in performance may lie in the fact that both types of farms employ different profit-maximizing strategies (based on a cost reduction or an output maximization). Cost-minimization strategies aimed at achieving a given output level are fundamental for non-certified farms, and explain their higher levels of pure technical efficiency.

The average scale efficiency values, however, show the PGI-certified farms to be the better performers. This is probably a further consequence of the different strategies adopted by the two groups. The profit to be made from the higher prices commanded by PGI meat (Bardaji *et al*, 2009) encourage certified farms to increase their output and, consequently, improve their scale efficiency performance (similar strategic behaviour differences were reported in Dimara *et al*, 2005).

Analysis of farm efficiency drivers

Table 3 shows the estimated Tobit models, which include only those variables that prove statistically significant in at least one of the estimated functions. Two different

Table 3. Estimated Tobit models.

Variable	GTE		PTE		SE	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Constant	0.666	1.88*	1.384	3.68***	0.531	1.50*
AGE	–0.005	–2.05**	–0.001	–0.47	–0.006	–2.28**
SIZE	$0.13{\cdot}10^{-5}$	2.11**	$0.85{\cdot}10^{-6}$	1.17	$0.12{\cdot}10^{-5}$	1.89**
NETSUB	–1.099	–4.02***	–0.822	–2.74***	–0.595	–2.18**
LIVDENS	0.009	0.69	0.035	1.64**	–0.0003	–0.02
LIVSPEC	0.594	1.76**	–0.189	–0.54	0.691	2.05**
DLOCAT	–0.115	–1.57*	–0.010	–0.14	–0.135	–1.86**
DPGI	0.056	0.86	–0.111	–1.56*	0.120	1.86**
Sigma	0.145	8.49***	0.147	7.08***		
Pseudo-R^2	0.530		0.545		0.521	
Max likelihood ratio	31.1***		20.7***		30.84***	

*, ** and *** denote statistical significance at the 15%, 10% and 1% levels respectively.

statistics (maximum likelihood ratio and Pseudo R^2) are used to test for goodness-of-fit. Acceptable fit levels are found in all three cases.

In terms of the impact of the age of the farm owner (AGE) on farm efficiency, the evidence from the literature is not conclusive. This study finds a negative coefficient for the impact of the farm operator's age (AGE) on farm efficiency, suggesting the lower efficiency of farms run by older farmers (according to Kamruzzaman and Manos, 2009). This may be due to lack of training and/or less incentive to invest in new technologies, since the expected return decreases as the farmer's age increases (Wallace and Moss, 2002).

Farm size, as might be expected, due to economies of scale, has a positive influence on efficiency, as indicated by the positive and statistically significant coefficient of the output variable, bringing the results of this research into line with various other studies (Karagiannis and Sarris, 2005; Iraizoz *et al*, 2005; Galanopoulos *et al*, 2006; Keinhanb *et al*, 2007). Nevertheless, other authors report that size lacks relevance to livestock farm efficiency (Rakipova and Gillespie, 2000), or find that the size effect depends on organizational form (Davidova and Latruffe, 2007).

The amount of subsidies received (NETSUB) has a negative effect on farm efficiency. This could be due either to higher subsidies reducing production incentives, or to less efficient farmers receiving larger amounts of subsidies (Van Passel *et al*, 2006). A similar finding has also been recorded by other authors (Karagiannis and Sarris, 2005; Iraizoz *et al*, 2005; Keinhanb *et al*, 2007).

As far as the intensification level is concerned, the coefficient associated with livestock density (LIVDEN) takes a positive significant value in the case of pure technical efficiency. This suggests that farms with a higher livestock density should present a higher efficiency level, as the results obtained in other applications would lead us to suppose (Dinar *et al*, 2007; Gaspar *et al*, 2009). However, this variable can also be considered as a proxy for environmental friendliness (Keinhanb *et al*, 2007). In this sense, these results could be considered disappointing, in that the more environmentally friendly the farm, the poorer its efficiency performance.

The variable included to capture the level of specialization in livestock farming (LIVSPEC) has a positive coefficient. The most highly specialized livestock production units present the highest efficiency levels. The owners of these farms are likely to possess more production process know-how (Llewelyn and Williams, 1996) and therefore a greater ability to make more efficient use of scant resources. In addition, higher reliance on the fortunes of a single product could be what pushes highly specialized cattle farmers to achieve superior performance (Karagiannis and Sarris, 2005).

The results obtained for the variable used to capture farm location (DLOCAT) indicate that the farms situated in the more mountainous areas of the region show significantly higher technical efficiency levels. This result appears to suggest that some areas are better endowed for livestock production, thereby confirming the generally accepted view in Navarre that livestock production is well suited to the northern part of the region, where it finds more favourable agricultural conditions.

Finally, PGI-certified farms show lower levels of technical efficiency but higher levels of scale efficiency, which may be due to the adoption of different operational strategies, as already mentioned. This finding is in line with that obtained by Dimara *et al* (2005), and reflects the above-mentioned differences in livestock farmers' production strategies.

Conclusions

The study objective was to assess some of the economic aspects of the PGI label, such as the economic performance, profitability and technical efficiency of a sample of farms. Although the relatively limited scope of the study restricts the generalization of the results, it is possible to draw valid conclusions while still acknowledging, along with other authors (Bosmans *et al*, 2005; OECD, 2006; Anders *et al*, 2009), the need for further research on a wider scale, incorporating new analytical techniques.

PGI-certified farms present better economic results than the rest, both in absolute and relative terms. In this respect, it is important to note the relevance of subsidies in both farm types. It is also worth noting that the PGI farms achieve higher levels of profitability, with significant differences in those indicators in which opportunity costs are included.

The above finding is largely supported by the technical efficiency estimates. The analyses performed appear to suggest that the production strategy used by certified farms is oriented towards the maximization of output, while the rest opt for cost-minimization strategies. One of the reasons for this is the difference in price commanded by the two classes of meat.

As far as the explanatory analysis is concerned, the results come into line with those that appear in the published literature. It is worth mentioning the positive impact of size and specialization on efficiency, in contrast to farmer age and reliance on subsidies, which impact negatively. PGI adoption has a significant positive effect on scale efficiency, thus confirming the effect of the various strategies described above.

From the point of view of the future development of agricultural policy measures, there is a risk of conflicting interests. The most environmentally friendly and the most heavily subsidized farms appear to be the least efficient. However, considering the role they play as environmental watchdogs in many rural areas, they might be considered worthy of economic aid to allow them to achieve a more respectable level of profitability. Without such subsidies, many of these farms would almost certainly be forced to abandon their activity.

In conclusion, the case study described in this paper appears to confirm that PGI certification contributes in a positive manner to rural development. Particularly worth noting is its role as an integrating force that helps to draw extensive livestock production units in mountainous areas into the agro-food chain. PGI farms are found to be associated with higher economic performance and efficiency improvement strategies, which may contribute towards their consolidation by safeguarding them against marginalization and abandonment. Thus, in the case considered, the PGI label has contributed to the development and sustainability of a livestock activity by creating better conditions than those existing outside it. It is nevertheless important to avoid drawing simplistic generalizations from this finding, since further research in other contexts is required to complete and refine the evaluation of this instrument of rural development.

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Notes

[1] This method was proposed by Charnes *et al* (1978). For a detailed description of this methodology, see, for example, Coelli *et al* (2005).

[2] Which is the most widely used in this analytical context (Hoff, 2007).

[3] Although the CAP reform of 2003 decoupled the majority of agricultural subsidies, the suckler cow premium and 40% of the slaughter premium, the most important subsidies for these farms, remain coupled.

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